

# Exhibit J



Preliminary Expert's Report

MARK CASSIDY and Others v VOYAGER

**IN THE UNITED STATES COURT  
FOR THE STATE OF FLORIDA**

**BETWEEN**

**MARK CASSIDY, on behalf of himself  
and all others similarly situated  
("CASSIDY")**

**Plaintiff**

**-and-**

**VOYAGER DIGITAL LTD, and VOYAGER DIGITAL LLC**

**("VOYAGER")**

**Defendants**

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**Preliminary Expert's Report  
December 19, 2021**

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**Notice**

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## **1. Introduction and Background**

- **I, Stephen Peter Castell, submit the following preliminary report declaring my interim and provisional opinions related to those technical issues and case documentation which I have been instructed to examine, as presently arising from this *CASSIDY v VOYAGER* matter.**
- **This preliminary report provides my provisional opinions, about which I may testify at the Trial on behalf of CASSIDY, in regard to these issues, as well as the bases of those opinions. This preliminary report is based on my study, examinations, investigations, expertise and experience to date, and sets forth the interim testimony that I am likely to present regarding my provisional opinions.**
- **I expect also to develop my testimony dependent on future disclosure of relevant documentation and other evidence, including computer software and systems; and may also eventually present testimony in rebuttal to any testimony and evidence that VOYAGER may present.**

### **1.1 Personal Information**

#### ***Personal Details***

**1.** I, Stephen Peter Castell, am a Chartered IT Professional and an independent consultant in computer and telecommunications systems and software development. I am Chairman of the United Kingdom company CASTELL Computer and Systems Telecommunications Limited ('CASTELL' or '*CASTELL Consulting*'), a professional firm of Management and Financial Consultants in Information Technology of over 40 years' standing. I am an expert in the specification, design, development, project direction and contract management of computer applications software; in areas of Information & Communications Technology ('ICT') and software applications industry custom and practice; in analysis of value and other assessments of software, systems and ICT outsourcing and other supply agreements; and in forensic examination of data and other records in respect of the validity, development and use of computer and telecommunications systems, of the consequences of such use, and the inferences and conclusions to be drawn from them. I have been instructed as an expert witness on a wide range of ICT and ICT services assignments, and related litigious and non-litigious disputes, and in particular, for example, in software copyright, and ICT technology patent, disputes, and in computer software and systems litigation; for both Plaintiffs, Claimants or Pursuers, and Defendants, Respondents or Defenders, and for both purchasers/users and providers/suppliers of ICT software, systems and services, and on behalf of insurers, in the UK, the USA, and internationally.

**2.** My qualifications, experience and a note of some of the cases on which I have been instructed as expert are given at ***Appendix ONE: Dr Stephen Castell – qualifications and experience*** of this **Preliminary Expert's Report**.

#### ***Authorship of this Preliminary Expert's Report***

**3.** I have personally carried out or directed all work undertaken in regard to my investigations, analyses and findings. I confirm that the conclusions and opinions expressed herein are entirely my own.



## **1.2 Background to the Dispute and my Appointment**

4. I was by Letter of Instruction dated July 16, 2021 (as given at **Appendix TWO: Documents Provided and Reviewed in this Report**), appointed and instructed by Attorney Adam Moskowitz, Partner, *The Moskowitz Law Firm, PLLC*, to produce an independent preliminary expert's report on behalf of his client, the Plaintiff, *MARK CASSIDY and Others*. I understand from my Letter of Instruction that a CLASS ACTION COMPLAINT AND DEMAND FOR JURY TRIAL is to be filed by Attorney Moskowitz on Behalf of the Plaintiff in a UNITED STATES COURT FOR THE STATE OF FLORIDA. However, as the Complaint has yet to be filed, I have been instructed to bear in mind that the expression of the allegations and claims in the case are provisional at this stage, and are highly likely to evolve in due course, with attendant likelihood of development of issues for me as an expert potentially to address in the future ('the Complaint').

5. I further understand from my Letter of Instruction that, in regard to the preliminary issues upon which I have been asked to opine, in the field of my expertise, the background to and the allegations in this case are in summary as follows:

- "Voyager, through its Voyager Platform, offers investors, developers and platform providers a fully functional suite of APIs and mobile apps to allow anyone who is legally able to do so the ability to trade, invest, earn and secure digital assets across multiple types of digital assets. According to its creators, Voyager 'is a publicly traded holding company whose subsidiaries operate a crypto-asset platform that provides retail and institutional investors with a turnkey solution to trade crypto assets. The Voyager Platform provides its customers with competitive price execution through its smart order router and as well as a custody solution on a wide choice of popular crypto-assets. Voyager was founded by established Wall Street and Silicon Valley entrepreneurs who teamed to bring a better, more transparent, and cost-efficient alternative for trading crypto-assets to the marketplace.'"
- Voyager Digital LLC ("VDL"), one of Voyager's subsidiaries, acts as a "crypto broker," being a digital agent broker that facilitates users buying and selling of cryptocurrencies delivering deep pools of liquidity. It also offers a single access point to research, manage, trade, and secure cryptocurrencies for novice and sophisticated investors.
- Included prominently throughout Voyager's uniform marketing representations to its customers is that the Voyager Platform offers trades that are "100% Commission-Free."
- Voyager's "100% Commission-Free" representations, however, are false and are reasonably likely to mislead objective consumers acting reasonably under the circumstances. While Voyager does not openly display the commissions it charges on each cryptocurrency trade, Voyagers utilizes various methods to secrete the exorbitant commissions it retains from every trade.
- To effectuate these unfair and deceptive business practices, the Voyager Defendants claim to use proprietary systems they have developed, which they refer to as the "Smart Order Router," the "Voyager Pricing Engine," and the "Proprietary Fills Algorithm."
- In describing the Smart Order Router, the Voyager Defendants maintain that the Voyager Platform "does not let clients post orders directly on the exchanges to which it connects or with the market makers that provide liquidity, but instead its Smart Order Router accepts customer orders and fills them in the market for the customer



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using its proprietary order routing algorithm." The Voyager Pricing Engine "calculates the fair market price while constantly analyzing the order books, executions, depth of liquidity, commissions and other proprietary factors across [Voyager's] liquidity sources and streams this price to its users."

- In reality, and unbeknownst to customers, the Voyager Defendants' "Smart Order Router," "Voyager Pricing Engine," and "Proprietary Fills Algorithm" are designed to be intentionally obscure and to provide Voyager with hidden commissions on every trade that in most cases exceed the disclosed fees and commissions charged by its competitors. Voyager unfairly gains an edge on its competition and overcharges customers by collecting these secret commissions to the detriment of its unknowing customers.
- After being exposed to the Voyager Defendants' representations that their Platform is "100% Commission-Free," the Plaintiff registered for an account on the Voyager Platform on March 17, 2021, and in reliance on the Voyager Defendants' representations, the Plaintiff executed a number of trades on the Voyager Platform, some of which are to be exhibited within the Complaint, for example as screenshots of the Plaintiff's May 11, 2021 'Market Buy trade at Order ID Dx65EW', enclosed herewith at Annex A".

**6. My Letter of Instruction further sets out that:**

"We anticipate and request that you will work as a computer evidence, software and systems procurement, development, performance and quality expert in consultation and co-ordination with Mr Rich Sanders, of *Cipherblade*, the blockchain forensics expert whom we are also retaining, with instructions to and arrangements made for him to access and make a series of concurrent test trades using the Voyager App, and, for comparison and contrast, using certain other different cryptocurrency trading platforms";

and requests and instructs me to:

- "Review the Complaint, in particular the screenshots enclosed herewith at Annex A, together with consideration of initial case documentation that we provide to you.
- Working with, but independently of, Mr Sanders, monitor, record, write-up and analyse the concurrent test trades that Mr Sanders will carry out using and operating the Voyager App and certain other cryptocurrency trading platforms.
- Produce examinations by way of provisional analyses, findings, conclusions and opinions, giving such insights as may be sensibly achievable based on both the restricted documentation available prior to discovery and disclosure and relying on the data obtained from the concurrent test trades that Mr Sanders will carry out. We recognize and agree that, prior to discovery and disclosure, these examinations cannot and will not include carrying out your own technical investigation or research on or into, nor testing of, the specific or detailed software and systems specification, design, construction, testing, commissioning, deployment, operation, user experience (including guides and documentation), maintenance and fault-logging of the Voyager App and other Voyager systems that may be involved.
- Provide a brief overview and explanation of the blockchain and cryptocurrency, crypto assets etc field to assist the understanding of the Court, in respect of principally a general introduction, plus as regards technical issues relevant in the case".



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**7.** This **Preliminary Expert's Report** is my account of the review that I have carried out, giving, as instructed, my explanations, findings, conclusions and preliminary opinions.

**1.3 Statement of Impartiality**

**8.** Prior to being appointed in this case, I have not worked or acted in any capacity for or on behalf of MARK CASSIDY and Others, or VOYAGER, or with regard to any matter in which they were or are involved. I believe that in this report the facts I have stated are true and the opinions I have expressed are correct.

**9.** I understand that my overriding duty is to assist the Court on matters that are within my expertise. I also understand that this duty overrides any obligation to *The Moskowitz Law Firm*, PLLC, who act for MARK CASSIDY and Others in this matter, or their clients. I further understand that, if called upon to provide a written report of my procedures and findings and to supply expert testimony at deposition, trial, or other hearings, my report will need to comply with federal and local court rules or procedures, if any, regarding expert reports; and, in connection with preparation of a report, opinion, or testimony on a matter, I will need to perform the procedures that I consider necessary to express a professional conclusion.

**10.** I further confirm that I have at all times conducted, and will at all times conduct, my expert inspections and examinations pursuant to the expected standards of impartiality and independence. Notwithstanding its provisional status, I confirm that this **Preliminary Expert's Report** is intended to comply with the applicable requirements of the Federal Rules of Civil Procedure, the Federal Rules of Evidence, and the best practices and guidelines developed by the US National Institute of Justice's Scientific Working Group on Digital Evidence. I acknowledge that the opinions I render in this matter shall be made in good faith and supported by a reasonable amount of research and analysis.



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## **2. Research Methodology**

### **2.1 Documents Reviewed**

**11.** On July 16, 2021, August 26, 2021, and October 28, 2021, I was provided with the documents given at ***Appendix TWO: Documents Provided and Reviewed in this Report*** of this **Preliminary Expert's Report**.

**12.** Where I make reference herein to a page or pages of any one of these documents, this is in one of the formats:

'n/N; <Pdf ID>': where n is the pdf page number in question located within the total of N pages in the document with 'Pdf ID'; or  
'P <page number(s) within document> <Document ID>', where 'Document ID' is as given in the following table:

<b>Document ID</b>
<u>Complaint</u>
<u>Plaintiff's Screenshots</u>
Annex A to Letter of Instruction: Screenshots of the Plaintiff's May 11, 2021, 'Market Buy trade at Order ID Dx65EW'
RESULTS OF TEST TRADES CARRIED OUT BY RICH SANDERS
'investor presentation sept 2021.pdf' (Voyager Digital Limited)
'Condensed Interim Consolidated Financial Statements 3 and 9 months ending march 31, 2021 and 2020.pdf' (Voyager Digital Limited)
'MDA for 3 and 9 months ended March 31 2021.pdf' (Voyager Digital Limited – "MANAGEMENT'S DISCUSSION AND ANALYSIS")

### **2.2 Investigations Carried Out**

**13.** The investigations that I have carried out have consisted of

- Reading and considering the documentation supplied to me, as given at ***Appendix TWO: Documents Provided and Reviewed in this Report*** of this **Preliminary Expert's Report**.
- Some limited literature, web etc research.





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### **3. Issues addressed in this Preliminary Expert's Report**

**14.** This **Preliminary Expert's Report** provides an account of my investigations, analyses, and findings in regard to my instructions to

- Review the Complaint, in particular the screenshots exhibited therein, together with consideration of the initial case documentation provided.
- Monitor, record, write-up and analyse the concurrent test trades carried out by Mr Sanders using and operating the Voyager App and certain other cryptocurrency trading platforms.
- Produce provisional analyses, findings, conclusions and opinions, giving such insights as may be sensibly achievable based on both the restricted documentation available prior to discovery and disclosure and relying on the data obtained from the concurrent test trades as carried out by Mr Sanders.
- Provide an introduction to the blockchain and cryptocurrency, crypto assets etc field to assist the understanding of the Court.

**15.** The relevant technical issues that fall within my field of expertise are the computer software and systems aspects of the Voyager App and other Voyager systems that may be involved.

**16.** I make it clear that I am not a capital or currency market trading professional or financial advisor, and neither offer nor provide investment advice. Neither do I have any commercial interest in or management connections with any cryptocurrency, cryptocurrency trading exchange or any operators of such entities or promoters of associated businesses.



## **4. Analysis and Findings**

### **4.1 Introduction to Blockchain and Cryptocurrency**

**17.** In simple terms, blockchain is the computer software and systems technology that (among other things) enables the existence of cryptocurrency. Bitcoin is the name of the best-known cryptocurrency, being the cryptocurrency for which blockchain technology was originally developed. Like the USD, a cryptocurrency is a medium of financial value exchange, but it is digital and uses encryption techniques to control the creation of monetary units and to verify the transfer of funds.

**18.** A blockchain is a software and systems application that provides a decentralized ledger of all transactions across a peer-to-peer network. The key principle of using blockchain is that participants can confirm transactions without a need for a central clearing authority. Potential applications in the financial and investment sector can include fund transfers, and settling trades. Other application areas, or 'use cases', for blockchain are myriad, and include voting, supply chain logistics management and health informatics.

**19.** Blockchain thus has potential applications far beyond Bitcoin and cryptocurrency. From a general business perspective, blockchain technology may be thought of as a type of next-generation business process improvement software. 'Collaborative technology' such as blockchain can offer the ability to improve the business processes that occur between companies, significantly lowering the 'cost of trust'. For this reason, there is a growing management and investor realization that, in the right use cases, blockchain may offer substantially higher returns 'for each investment dollar spent' than many traditional corporate internal technology investments.

**20.** I set out further basic introduction to and explanation of blockchain and cryptocurrency in general, and Bitcoin in particular, in ***Addendum A: Introduction to Blockchain and Cryptocurrency*** of this **Preliminary Expert's Report**.

### **4.2 Scope of Expert Work**

**21.** The expert investigations that it seems to me need to be carried out to undertake the analyses required by my instructions in order to arrive at conclusions and opinions on the issues, of assistance to the court, include within their scope examination of:

- Computer Software & Evidence – within Voyager App (smartphone or other end-user platform).
- Computer Software & Evidence – within Voyager Digital Company ('backend', middleware, interconnections with other systems, especially price data feeds from trading exchanges etc).
- Computer Software & Evidence – Third Parties.
- Algo Software – 'Best Execution Price' Computer Software and Systems, Techniques, etc: (a) Voyager Digital's software and systems, in particular, its "Smart Order Router," the "Voyager Pricing Engine," and the "Proprietary Fills Algorithm"; and (b) software and systems in Financial Services, Market Trading and Price Comparison industries generally.



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**22.** However, based on the restricted documentation available prior to Defendants' discovery and disclosure, for the purposes of producing my provisional opinions for this **Preliminary Expert's Report**, undertaking the full scope of these investigations is simply not possible. I am therefore able, and am instructed, only to consider here the contents of the Complaint and associated support documentation, together with the data obtained from the concurrent test trades as carried out by Mr Sanders.

**4.3 Review of the Complaint**

**23.** Reviewing the Complaint, it appears to me that, as far as can be seen at present, the core expert questions to be addressed are:

**(i)** To what extent does the available technical evidence show that the Voyager App does not materially provide the user functionality as represented by Voyager Digital (a) as regards achieving the 'best market price' or 'fair market price' for the user/trader (whether that failure to provide the represented functionality is centred principally within the "Smart Order Router," the "Voyager Pricing Engine," the "Proprietary Fills Algorithm"; and/or any other Voyager Digital system component); and/or (b) as regards any other representations or claims made.

**(ii)** Is there any evidence that the Voyager App fails to perform in compliance with the representations made by Voyager Digital (if it materially does not) due to faults in design, construction and operation thereof, as distinct from being deliberately and intentionally fashioned to perform in the way that it does?

**(iii)** To what extent is it possible to determine the extent of the financial consequences of the Voyager App's not providing the user functionality as represented by Voyager Digital (if it materially does not) on any Voyager App user's cryptocurrency or other trading?

**(iv)** Does the technical governance of Voyager Digital in the management, operation, integrity, representations and security of its Voyager App and of its other management and customer systems meet accepted professional standards for, and/or custom and practice in, the consumer electronic financial services and/or online trading sectors?

**24.** I set out in the following paragraphs my analysis and findings as regards each of these questions, to the extent possible prior to discovery and disclosure.

**25. (i)** To what extent does the available technical evidence show that the Voyager App does not materially provide the user functionality as represented by Voyager Digital (a) as regards achieving the 'best market price' or 'fair market price' for the user/trader (whether that failure to provide the represented functionality is centred principally within the "Smart Order Router," the "Voyager Pricing Engine," the "Proprietary Fills Algorithm,"; and/or any other Voyager Digital system component); and/or (b) as regards any other representations or claims made.

**26.** I have examined the RESULTS OF TEST TRADES CARRIED OUT BY RICH SANDERS documentation provided to me, as contained in the Preliminary Expert's Report of Mr Rich Sanders of *Cipherblade*. I have arrived thereby at the following understandings and provisional findings.



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**(a)** Based on a sample of approximately 30 illustrative trades carried out through use of the Voyager App (whether 'buy' or 'sell' trades), when executed near-simultaneously, for controlled comparison purposes, with the identical trades carried out direct with/on one or more cryptocurrency exchanges (such as Coinbase, Binance, FTX, Kraken), such that the latter direct trades may in my opinion be taken, between them, as having been executed at the realistic 'best market price' or 'fair market price' practically achievable in the market for each such trade, on each and every occasion the trade in the sample as confirmed by execution of the Voyager App was executed at a comparatively worse price. That is, whether a 'buy' or 'sell' trade, each such trade resulted in an overcharge to the Voyager App user compared with the trade executed direct on exchanges.

**(b)** In my view this overcharge to the Voyager User may be characterised or thought of as essentially an undisclosed commission levied by Voyager Limited. The overcharge/undisclosed commission varied somewhat per individual trade, between approximately 0.5% and 1% of the value of the trade, across all trades in the sample, i.e. the overcharge was never less than 0.5% of the value of the trade.

**27.** Taking these results into account, in my preliminary view it is quite clear that the technical evidence so far available shows that the Voyager App does not materially provide the user functionality as represented by Voyager Digital as regards achieving the 'best market price' or 'fair market price' for the user/trader.

**28. (ii)** Is there any evidence that the Voyager App fails to perform in compliance with the representations made by Voyager Digital (if it materially does not) due to faults in design, construction and operation thereof, as distinct from being deliberately and intentionally fashioned to perform in the way that it does?

**29. (a)** In my experience, it is in principle conceivable that the failure of the Voyager App to perform in compliance with the representations made by Voyager Digital (which failure, in the light of the RESULTS OF TEST TRADES CARRIED OUT BY RICH SANDERS, is clearly materially evident), and the resulting overcharge to the Voyager App user, could perhaps be due to faults in design, construction and operation, as distinct from (and/or in addition to) being deliberately and intentionally fashioned to perform in the way that it does. However, until Defendant's discovery and disclosure of all relevant documentation and data pertaining to the Voyager App, and the Voyager Digital, software and systems, I am presently unable to carry out any substantive examinations or analysis speaking to answering this question.

**(b)** In the meantime, whether the overcharge is as a result, on the part of Voyager Digital's management, of a fault in Voyager Digital's software development management, i.e. the company's software design, build, testing, deployment and operational processes, or arises from a deliberate intent of the company to deceive and overcharge the users of its Voyager App, or some combination of both, in my view and experience, and dependent, as noted herein, on due inspection and examination of the software development, management and operational documentation to be disclosed by Voyager Digital, such overcharge provisionally appears to me to be a definite *software material defect*. I naturally defer to the court to make that finding legally in due course, and, if so, determine what restitution and compensation falls to be provided by Voyager Digital for the financial consequences of such a software material defect.

**(c)** However, and subject to the Discovery that will be necessary to analyze definitively whether what the Voyager Digital company's management is doing is intentional, in my



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preliminary view, since the overcharge/undisclosed commission appears to be present in every trade, it is highly likely that the Voyager App is deliberately conceived and designed by the company's management to function that way, or, equally, the company's management has grossly failed to discharge its requisite IT and corporate governance duties, and has failed to correct this software material defect, perhaps because it is to their company's benefit. It seems highly unlikely to me that the Voyager Digital company's IT and corporate management did, and does, not know (and, if not, it should), what was and is happening as regards this software material defect and its overcharge/undisclosed commission financial consequences to the Voyager App user.

**30. (iii)** To what extent is it possible to determine the extent of the financial consequences of the Voyager App's not providing the user functionality as represented by Voyager Digital (if it materially does not) on any Voyager App user's cryptocurrency or other trading?

**31.** Until Defendant's discovery and disclosure of its financial accounting systems, software and data, so that an examination of actual accounting records can be undertaken and a determination made of the scale of the quantitative financial consequences on any Voyager App user's cryptocurrency or other trading, I am presently unable to carry out an analysis, on a realistic calculated, grounded data basis, speaking to answering this question.

**32.** In the meantime I tentatively analyse, by way of an estimate, as follows. For purposes of commencing estimate calculations I consider for illustration:

10,000 Voyager App users; and

\$1,000 of buy trades each per user, per month, on average.

Using these illustrative nominal figures gives a total of  $10,000 \times \$1,000 = \$10\text{m}$  of buy trades per month executed by Voyager Digital across all Voyager App users, that is a total of  $12 \times \$10\text{m} = \$120\text{m pa}$ . From the RESULTS OF TEST TRADES CARRIED OUT BY RICH SANDERS summarised above, it appears highly likely that the Voyager App causes each buy trade of every user to cost at least 0.5% more than the 'best price' or 'fair price' that the Voyager App promises. On the above 'nominal figures' basis, this would therefore amount to a total buy trades overcharge to all Voyager App users running at a rate of at least  $0.5\% \times \$120\text{m pa} = \$0.6\text{m pa overcharge}$ .

**33.** However, this estimate of a \$0.6m pa overcharge to all Voyager App users is an illustrative result only, based simply on assumed nominal figures. I now move on from those assumed nominal figures, and refer to Voyager Digital's own actual data: on pages 9-11/28 of the Voyager Digital Limited document 'investor presentation sept 2021.pdf', I note the following financial details presented:

"Key Metrics: Verified Users 9/7/21 2.0 million

Fiscal 3Q Highlights (millions): Revenue \$60 Operating Profit \$30 Operating Margin 50%

Where we are today: \$5.0B+ Assets Under Management

Voyager Timeline: Q3/20 \$150MM AUM ... Q1/21 \$1.7B AUM ... Q2/21 \$3.3B AUM & \$100MM+ Quarterly revenue ...".

**34.** These details appear also to be consistent with, and confirmed by, the accounts and presentations given in the Voyager Digital Limited documents 'Condensed Interim Consolidated Financial Statements 3 and 9 months ending march 31, 2021 and 2020.pdf' and 'MDA for 3 and 9 months ended March 31 2021.pdf'. The links I have noted at end of this paragraph additionally essentially present discussion and figures that are consistent with these. The Voyager accounts and presentations show, on Voyager Digital's own March 2021



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announced figures therein, that the company had Assets Under Management (AUM) exceeding \$2.4 billion, with Total Funded Accounts as at March 2021 at over 270,000, suggesting a persistent level of funding available for buy trades per user of  $\$2.4\text{bn} / 270,000 = \$8,889$  on average per user (rather than the \$1,000 that I assumed in my nominal figures). The Voyager Digital Limited document 'investor presentation sept 2021.pdf' states that Voyager's AUM as at September 2021 were \$5.0 billion, i.e. its AUM had grown  $(5.0-2.40/2.4) = 108.33\%$  between March 2021 and September 2021. I make what I believe is a reasonable assumption that the company's Total Funded Accounts would in the same period have grown *pro rata* and thus have been at the level of slightly over double the figure at March 2021, i.e.  $(270,000 \times 108.33\%) + 270,000 = 562,500$ . These September 2021 figures therefore suggest once again a persistent level of funding available for buy trades per user of  $\$5.0\text{bn} / 562,500 = \$8,889$  on average per user.

<https://www.fool.com/the-ascent/cryptocurrency/voyager-crypto-review/>

Voyager Review: Buy & Sell 50+ Digital Currencies on This User-Friendly App Nov. 11, 2021 ... Voyager says you can earn up to 9% APY on stablecoins, such as USDC, and 6.25% on Bitcoin ... Voyager is a cryptocurrency broker that facilitates trading across more than a dozen of the best cryptocurrency exchanges. It's not an exchange itself; instead, it uses proprietary technology called the Voyager Smart Order Router to give customers access to dozens of currencies across multiple exchanges. ... You have to download the app to use Voyager ... Voyager trades are technically commission-free -- you never pay anything above the quoted price for a trade. Instead, Voyager takes a small cut of the difference if it finds you a price below its quote and lets you keep the rest. So Voyager only takes money if it saves you money. ...

<https://blockworks.co/voyager-digital-preliminary-revenue-drops-40-from-previous-quarter/>

Voyager Digital Preliminary Revenue Drops 40% from Previous Quarter October 6, 2021 Voyager projects its revenue for its fiscal 2022 first quarter ending on September 30 to be between \$63 million to \$67 million, down from \$109 million in the previous quarter ending on June 30. ... Although revenue is projected lower, Voyager's total verified users on its platform increased to more than 2.15 million, up about 23% from 1.75 million in the previous quarter, according to the data ...

<https://www.prnewswire.com/news-releases/voyager-digital-provides-business-update-and-march-2021-metrics-301262690.html>

Voyager Digital Provides Business Update and March 2021 Metrics Apr 06, 2021 ... Assets Under Management (AUM) exceeded US\$2.4 billion. Total Funded Accounts at the end of March 2021 were over 270,000. Total Verified Users on the platform were over 1 million. ...

**35.** Relying on Voyager Digital's own data, therefore, it seems to me that, for the current calendar year 2021, and looking forward four more years, i.e. for the period 2021-2025, reasonably estimated projections are given by the following table, in which I make what I believe are conservative assumptions, as follows:

- Total Number of Voyager Funded Accounts: increase by 30% each year.
- Actively trading Voyager App users: are 40% of Total Number of Voyager Funded Accounts in each year.





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Year	Total Number of Voyager Funded Accounts, as at September in each Year: Assume increases by 30% each Year	(i) Actively trading Voyager App users: Assume = 40% of Total Number of Voyager Funded Accounts in each Year	(ii) Amount of buy trades each per actively trading Voyager App user, per annum, on average: assume constant at \$8,889pm x 12	Likely total overcharge to all actively trading Voyager App users in the Year = (i) x (ii) x 0.5% Million
<b>2021</b>	562,500	225,000	\$106,668	\$120
<b>2022</b>	731,250	292,500	\$106,668	\$156
<b>2023</b>	950,625	380,250	\$106,668	\$203
<b>2024</b>	1,235,813	494,325	\$106,668	\$263
<b>2025</b>	1,606,556	642,622	\$106,668	\$343
<b>TOTALS</b>	<b>5,086,744</b>	<b>2,034,697</b>		<b>\$1,085</b>

In summary, relying on Voyager's own reported figures, and setting out what I believe are reasonable (conservative) projections, I make my preliminary finding that an estimate for the total overcharge to all actively trading Voyager App users over the years 2021-2025 is highly likely to be at least \$1,085m.

**36. (iv)** Does the technical governance of Voyager Digital in the management, operation, integrity, representations and security of its Voyager App and of its other management and customer systems meet accepted professional standards for, and/or custom and practice in, the consumer electronic financial services and/or online trading sectors?

**37.** Until Defendant's discovery and disclosure of the Voyager Digital corporate management policies, procedures, staffing, and business, financial and technical governance documentation, I am presently unable to carry out any substantive examinations or analysis speaking to answering this question definitively. However, in the interim (and taking into account findings in Mr Sanders' report concerning how, for example, Voyager systems transfer money to *HTC Trading*, or use customer funds for Voyager to trade for its own account on *Binance*), my provisional view is that the technical governance of Voyager Digital in the management, operation, integrity, representations and security of its Voyager App and of its other management and customer systems are unlikely to meet accepted professional standards for, and/or custom and practice in, the consumer electronic financial services and/or online trading sectors.



## 5. Provisional Conclusions and Opinions

38. I have carried out my instructions to

- Review the Complaint, in particular the screenshots exhibited therein, together with consideration of the initial case documentation provided.
- Monitor, record, write-up and analyse the concurrent test trades carried out by Mr Sanders using and operating the Voyager App and certain other cryptocurrency trading platforms.
- Produce provisional analyses, findings, conclusions and opinions, giving such insights as may be sensibly achievable based on both the restricted documentation available prior to discovery and disclosure and relying on the data obtained from the concurrent test trades carried out by that Mr Sanders.
- Provide an introduction to the blockchain and cryptocurrency, crypto assets etc field to assist the understanding of the Court;

and declare that my provisional conclusions and opinions are as follows.

39. I have provided an introduction to and explanation of blockchain and cryptocurrency in general, and Bitcoin in particular, in **Addendum A: Introduction to Blockchain and Cryptocurrency** of this **Preliminary Expert's Report**.

40. On the basis of my preliminary review and analysis of the contents of the Complaint and associated support documentation:

(i) To what extent does the available technical evidence show that the Voyager App does not materially provide the user functionality as represented by Voyager Digital (a) as regards achieving the 'best market price' or 'fair market price' for the user/trader (whether that failure to provide the represented functionality is centred principally within the "Smart Order Router," the "Voyager Pricing Engine," the "Proprietary Fills Algorithm," and/or any other Voyager Digital system component); and/or (b) as regards any other representations or claims made.

In my preliminary view it is clear that the available technical evidence shows that the Voyager App does not materially provide the user functionality as represented by Voyager Digital as regards achieving the 'best market price' or 'fair market price' for the user/trader.

41. (ii) Is there any evidence that the Voyager App fails to perform in compliance with the representations made by Voyager Digital (if it materially does not) due to faults in design, construction and operation thereof, as distinct from being deliberately and intentionally fashioned to perform in the way that it does?

In my experience, it is conceivable that the, clearly materially evident, failure of the Voyager App to perform in compliance with the representations made by Voyager Digital, and the resulting overcharge to the Voyager App user, could perhaps be due to faults in design, construction and operation. However, until Defendant's discovery and disclosure of all relevant documentation and data pertaining to the Voyager App, and the Voyager Digital, software and systems, I am presently unable to answer this question. In the meantime, whether through an unintentional failure, or deliberate act, in my view such overcharge provisionally appears to be a definite *software material defect*, and it seems highly unlikely to me that the Voyager Digital company's IT and corporate management did, and does, not know (and, if not, it should), what was and is happening as regards this software material defect and its overcharge/undisclosed commission financial consequences to the Voyager App user.





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**43. (iii)** To what extent is it possible to determine the extent of the financial consequences of the Voyager App's not providing the user functionality as represented by Voyager Digital (if it materially does not) on any Voyager App user's cryptocurrency or other trading?

Making what I believe are reasonable assumptions, relying on Voyager's own reported figures, and setting out what I believe are conservative projections, I provisionally assess the total overcharge to all actively trading Voyager App users over the years 2021-2025 is highly likely to be at least \$1,085m.

**44. (iv)** Does the technical governance of Voyager Digital in the management, operation, integrity, representations and security of its Voyager App and of its other management and customer systems meet accepted professional standards for, and/or custom and practice in, the consumer electronic financial services and/or online trading sectors?

Until Defendant's discovery and disclosure of the Voyager Digital corporate management policies, procedures, staffing, and business, financial and technical governance documentation, I am presently unable to carry out any substantive examinations or analysis speaking to answering this question. However, my provisional view is that the technical governance of Voyager Digital in the management of its Voyager App, and of its other management and customer systems, are unlikely to meet these accepted professional standards, and/or relevant custom and practice.

**45.** In summary, it is my firm preliminary opinion that the Voyager App does not materially provide the user functionality as represented by Voyager Digital as regards achieving the 'best market price' or 'fair market price' for the user/trader.

**46.** Furthermore, in my preliminary opinion the failure of the Voyager App to provide the represented functionality is likely to be accounted for by elements of the coding or programmed behaviour of its "Smart Order Router," and/or its "Voyager Pricing Engine," and/or its "Proprietary Fills Algorithm", either acting alone, amongst themselves, or in conjunction with the Voyager Digital corporate software and systems with which these modules connect and inter-operate. However, prior to Defendant's discovery and disclosure, it is not possible for me to determine any further details or insights on the matter, and it will be essential, in order for me to carry out the expert examinations reasonable to arriving at the necessary conclusions and opinions addressing this issue, that disclosure is given of all relevant software documentation including but not limited to software and systems specification, design, construction, testing, commissioning, deployment, operation, user experience (including guides and documentation), maintenance and fault-logging of these elements of the Voyager App and of the other Voyager Digital systems involved.

**47.** Prior to Defendants' discovery and disclosure, it has not been possible in this **Preliminary Expert's Report** for me to arrive at any finding or conclusion as to whether there is evidence that the Voyager App's material failure to perform in compliance with the representations made by Voyager Digital is due to faults in design, construction and operation thereof, as distinct from being deliberately and intentionally fashioned to perform in the way that it does.

**48.** Prior to Defendants' discovery and disclosure, it has not been possible in this **Preliminary Expert's Report** for me to arrive at any finding or conclusion, other than on an assumptive basis, as to what is the extent of the financial consequences of the Voyager App's material failure to provide the user functionality as represented by Voyager Digital on any Voyager App



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user's cryptocurrency or other trading. In the meantime, making what I regard as reasonable assumptions and projections, I have made a provisional estimated assessment that the total overcharge to all actively trading Voyager App users over the years 2021-2025 is highly likely to be at least \$1,085m.

**49.** In order for me to develop an objectively justifiable model for and accurate quantitative assessment of the quantum of such financial consequences, based on reliable financial and accounting records, it is imperative in my view and experience that disclosure includes all relevant transaction and accounting financial books and records kept and maintained by Voyager Digital pertaining to each Voyager App user's cryptocurrency or other trading, whether held digitally, manually or in or on other media.

**50.** Based on the evident material failure of Voyager Digital to provide its promised Voyager App 'best market price', and '100% Commission Free', user functionalities, whether those failures be through deliberate policy and systems design, or through faults in software construction and operation, I am of the preliminary opinion that the technical governance of Voyager Digital in the management, operation, integrity, representations and security of its Voyager App and of its other management and customer systems are likely not to meet, in whole or in part, accepted professional standards for, and/or custom and practice in, the consumer electronic financial services and/or online trading sectors, but cannot arrive at a final considered view prior to Defendants' discovery and disclosure.

***Overall Summary of my Provisional Conclusions and Opinions***

**51.** It is my firm view that for the purposes of my expert investigations to assist the Court with its judicial pursuit and determination of, or in otherwise resolving, the Complaint, the Voyager company must declare and disclose all documentation, materials and data, including financial accounting data, relating to the development, functioning and operation of the Voyage App, and the software and systems with which it inter-operates or interfaces, including third-party network or other connections such as those to and with cryptocurrency exchanges. This is in order that my software and systems expert examination and investigation may reasonably be carried out, intended to arrive at independent technical findings, conclusions and opinions as to the specification, objective, intent, design, algorithms, code construction, behavior, testing, faults, deployment, support, maintenance, revision and operational user ticket handling, and the operational and financial consequences thereof, as they apply and relate to the Voyager App and all relevant Voyager company software and systems.



## 6. Appendices

### **Appendix ONE: Dr Stephen Castell – qualifications and experience**

Management, Financial and Business Development Consultant in Information Systems, Computer and Communications Software, Technologies, Industries, Legislation and Regulation, Broadcasting, Media, Telecommunications, Internet, E-commerce. New Entrepreneurial Business Development Specialist. Expert Witness. CEDR-Trained Mediator, ICC Arbitrator, Expert Determiner. On the List of Experts: Arbitration and Mediation Center, *World Intellectual Property Organization*, Geneva  
Analytical • Creative • Practical • Professional

#### **Education**

##### University of Nottingham

PhD in Mathematics : "*Certain Transformations in Gas- and Magnetogas- Dynamics*".

Whole PhD thesis published in international mathematics/physics journals. Postgraduate Prizewinner.

MSc in Mathematics (Computer Science and Fluid Mechanics)

##### University of London

BSc First Class Honours in Mathematics, Physics and Psychology

##### Schooling

Hamond's Grammar School, Swaffham, Norfolk

11 'O' Levels, 2 'A' Levels. House Captain. Athletics *Victor Ludorum*.

Prince Rupert School, Wilhelmshaven, Germany Magnus Grammar School, Newark, Notts.

#### **Career**

1978 to present: Chairman, Castell Computer and Systems Telecommunications Ltd

(‘CASTELL’ or ‘CASTELL Consulting’)

Own independent consultancy company. CASTELL specialises in the strategising, planning, management and development of businesses in information and communications technologies, broadcasting and the media, and in analysing and influencing the financial, market, economic, regulatory and legal factors which affect them. It undertakes professional consultancy in IT and communications software/systems development, management and strategy. Dr Castell is in particular well known for the high quality and effectiveness of his work as an Expert Witness in major computer software and systems litigation having developed powerful techniques of *Forensic Systems Analysis*, and having achieved a special reputation in researching computer law and evidence issues. He has a track-record for business development/management in the fields of professional services, e-commerce/the internet, new media, databroadcasting, satellite, digital television, and image, voice, data and multimedia communications, particularly for entrepreneurial new companies and corporate venturing.

Previously:

- Manager, Group Management Services  
Bremar Holdings Ltd, international merchant bankers
- Consultant, Touche Ross & Co, Management Consultancy
- Senior Mathematician, Bearing Research Centre, RHP plc
- Applied Mathematician, Chalfont Park Research Laboratories, BACo plc.

#### **Publications**

A large number of papers and articles in national, international, professional, trade and technical press on IT, mathematical, technology, finance and investment subjects. Bestseller book "*Computer Bluff*", 1983. "*The APPEAL Report*", May 1990, a major study commissioned by the CCTA (H M Treasury) on admissibility of computer evidence in court and the legal reliability/security of IT systems. Numerous letters published in e.g. *The Times* and *Financial Times* on business, finance, technology, communications, science and law topics. Many appearances at International Conferences to present papers on e.g. information services, software, databroadcasting, satellite business services, digital television, computer evidence, venture capital, enterprise management, litigation and ADR. Author and Presenter of ‘*Avoiding IT Disasters – the Expert Way*’ Course, first held Nice, France, March 2005. His seminal paper ‘*Forensic Systems Analysis: A Methodology for Assessment and Avoidance of IT Disasters and Disputes*’ was issued as a *Cutter Consortium Executive Report*, Enterprise Risk Management & Governance Advisory Service series (Vol. 3, No. 2, March 8, 2006). Author of the much-cited ‘*The future decisions of RoboJudge HHJ Arthur Ian Blockchain: Dread, delight or derision?*’, *Computer Law & Security Review*, Volume 34, Issue 4, August 2018, Pages 739-753, the Landmark 200th issue of *CLSR* under the Editorship of Emeritus Professor Steve Saxby. <https://doi.org/10.1016/j.clsr.2018.05.011>.



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### Other Qualifications

CITP, Chartered IT Professional  
FIMA, MInstP, MBCS, MCMI, CPhys, MIOd  
MEWI, Member of the Expert Witness Institute  
Law Society's Directory of Expert Witnesses

### Languages

Working knowledge of French and German

### Awards and Recognitions

Medallist, *IT CONSULTANT OF THE YEAR*, British Computer Society IT Professional Awards, 2004.  
*Corporate America News* Expert Witness of the Year 2016 (Risk Assessment & Management).  
Computers Expert Witness of the Year (*Lawyer Monthly*), Expert Witness Awards 2016.  
2019: Honoured with an interview for *Archives of IT: Capturing the Past, Inspiring the Future*  
*In-depth experiences of the people who influenced the development of IT in the UK:*  
<https://archivesit.org.uk/interviews/stephen-castell/>

### Recreations

Business, Family. Swimming, Music, Sailing, Tennis. Patron, *London Cantamus Bach Choir and Orchestra*.  
Past Parent School Governor, 1982-1985. Endowed "*Castell Computer Creativity Contest*".  
Committee Member, British Computer Society (BCS) *Law Specialist Group*.  
Member, Real Time Club. Past Member, Working Groups of BCS Strategy Review Panel.  
Past Member, BCS *Legal Affairs Committee*.  
Past Correspondent Panel Member, *Computer Law and Security Report* (now *Review*), Elsevier.

### CASTELL Consulting's clients have included:

Airtours plc (Expert Witness in its action *versus* EDS)  
Axon Solutions Ltd (Expert Witness on behalf of *Hiscox*, its PI Insurers, in re its position as Part 20 Defendant in the *W H Smith versus Fujitsu Siemens Computers* action concerning UK's largest SAP implementation)  
British Broadcasting Corporation (BBC Data; Telecoms/Broadcasting Regulatory & Business Strategy)  
BBC Enterprises Ltd (BBC Datacast; BBC Eurocast/OLYMPUS Satellite)  
British Telecom plc (New Venture Business Development; Satellite Services)  
BT Syntegra (Expert Witness in its actions *versus* Ministry of Defence; and SwapsWire)  
Cable and Satellite Telecomms. Ltd (National Transcommunications Privatisation; Channel 5 TV Licence Bid)  
Central Computer and Telecommunications Agency (CCTA, H M Treasury, British Government)  
Cincinnati Bell Information Systems Ltd (Cable TV/Telephony Systems and Services)  
Department of Trade and Industry, British Government (Telecoms Product Development; VANS Licensing)  
European Commission/BT Tallis (INFOSEC Trusted Third Party Services)  
European Space Agency (Satellite Databroadcasting) France Telecom (New Venture Advice; AT&T Telemarketing)  
GEC-Marconi (Expert Witness in its action *versus* London Fire and Civil Defence Authority)  
H M Treasury (Expert Witness - Lord Chancellor's Department in its action *versus* Price Waterhouse)  
HSR, Milan (Expert Witness in its action *v. ACT Medisys* re Hospital IS for large Italian Hospital)  
International Chamber of Commerce, Paris (Arbitrator in 3-man ICC Arbitral Tribunal, European litigants)  
INFOCAST/Citibank (Databroadcasting Strategy)  
London Ambulance Service (Expert Witness in its action *versus* CAP-CGS)  
Mercury Communications Limited (National Transcommunications Privatisation)  
Misys plc (Expert Witness on major cases in the UK, Italy, Ireland, Australia; Business/Product Strategies)  
Motorola (Mobile Communications Interconnect and Licensing)  
Pearson Group plc/Financial Times (Databroadcasting Strategy)  
Personal Communications Networks: Mercury PCN and Unitel  
SAIT Electronics SA, Belgium (Satellite Communications and Databroadcasting Development)  
Superdrug Stores Plc (Expert Witness in its actions *versus* TEC UK Ltd)  
The Meteorological Office, UK (New Business Development: Data/Databroadcasting Services)  
The Press Association, London (Satellite Data Distribution).  
Transfield Obayashi Joint Venture (Expert re Australia's largest infrastructure project, *Melbourne Citylink*)  
United Arab Shipping Company S.A.G., Kuwait (Expert Witness in software action *v. BIDM, Inc*, New York)

### Links

<http://www.e-expertwitness.co.uk>  
<http://www.computerweekly.com/Articles/2005/09/13/211761/Disasterbutnorecovery.htm>



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**Appendix TWO: Documents Provided and Reviewed in this Report**

*In separate files.*

1. I received on July 16, 2021, '20I6120-2021.07.16 - CASTELL - Moskowitz Law Firm - Letter of Instruction - Voyager App (FINAL).DOC.pdf'.

2. I also received on July 16, 2021, from *The Moskowitz Law Firm, PLLC*:

Document ID
Complaint
Annex A to Letter of Instruction: Screenshots of the Plaintiff's May 11, 2021, 'Market Buy trade at Order ID Dx65EW'

3. I received on August 26, 2021, a spread sheet 'Voyager trade comparison.xlsx', together with graphs and commentary, from Rich Sanders of *Cipherblade*, the blockchain forensics specialist I understand also engaged by *The Moskowitz Law Firm, PLLC*, as an independent expert in this matter:

Document ID
RESULTS OF TEST TRADES CARRIED OUT BY RICH SANDERS Contained in '[Draft] Preliminary Expert Report of Richard A. Sanders (Cassidy and others v. Voyager).docx'

4. I further received on October 28, 2021, from *The Moskowitz Law Firm, PLLC*:

Document ID
'investor presentation sept 2021.pdf' (Voyager Digital Limited)
'Condensed Interim Consolidated Financial Statements 3 and 9 months ending march 31, 2021 and 2020.pdf' (Voyager Digital Limited)
'MDA for 3 and 9 months ended March 31 2021.pdf' (Voyager Digital Limited – "MANAGEMENT'S DISCUSSION AND ANALYSIS")



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## **7. Addendum A: Introduction to Blockchain and Cryptocurrency**

### ***Introduction and Overview***

A blockchain is a digital record of transactions. The name comes from its structure, in which individual records, called blocks, are linked together in single list, called a chain. Blockchains are used for recording transactions made with cryptocurrencies, such as Bitcoin, and have many other applications.

Each transaction added to a blockchain is validated by multiple computers on the Internet. These systems, which are configured to monitor specific types of blockchain transactions, form a peer-to-peer network. They work together to ensure each transaction is valid before it is added to the blockchain. This decentralized network of computers ensures a single system cannot add invalid blocks to the chain. When a new block is added to a blockchain, it is linked to the previous block using a cryptographic hash generated from the contents of the previous block. This ensures the chain is never broken and that each block is permanently recorded. It is also intentionally difficult to alter past transactions in blockchain since all the subsequent blocks must be altered first.

While blockchain is widely known for its use in cryptocurrencies such as Bitcoin, Litecoin, and Ether, the technology has several other uses. For example, it enables 'smart contracts', software programs which execute when certain conditions are met. This can provide an automated escrow system for transactions between two parties. Blockchain can potentially be used to allow individuals to pay each other without a central clearing point, as in Automated Clearing House and wire transfers. It has potential to increase markedly the efficiency of stock trading by allowing transactions to settle almost instantly instead of requiring three or more days for each transaction to clear.

Blockchain technology can also be used for non-financial purposes. For example, the InterPlanetary File System (IPFS) uses blockchain to decentralize file storage by linking files together over the Internet. Some digital signature platforms now use blockchain to record signatures and verify documents have been digitally signed. Blockchain can also potentially be used to protect intellectual property by linking the distribution of content to the original source.

### ***How Bitcoin really works***

The question "Hey, how does it 'really work', this Bitcoin?" is often heard, and it can seem that there is considerable confusion, and possibly misinformation, on the subject.

If you could 'pick up a Bitcoin and look it over', what would you see? Well, *nothing* meets the eye—the Bitcoin is contained in something that is virtual, rather than anything physical, a *Bitcoin wallet*, essentially the equivalent of a bank account. This wallet allows Bitcoin to be received, stored, and then sent on to others. If you own Bitcoin, think of the wallet that contains it as your personal interface to the Bitcoin network, similar to how your online bank account is an interface to the regular monetary system. This wallet contains a private key, a secret code, that allows you to transfer or trade Bitcoin.







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## Transactions

<div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>5</div> <div>Next</div> <div>+10</div> </div>		
Hash	1d9a54595ce5f475453f776e30bb6677f11e6b60a032e2fefdfb0bfa...	2020-03-10 15:25
	COINBASE (Newly Generated Coins)	
	→ 1CK6KHY6MHgYvmRQ4PAafKYDrg1ejbH1cE	12.74788347 BTC
	OP_RETURN	0.00000000 BTC
	OP_RETURN	0.00000000 BTC
Fee	0.00000000 BTC (0.000 sat/B - 0.000 sat/WU - 290 bytes)	12.74788347 BTC

**4. That 1 bitcoin is then sold on to a first buyer, just 1 bitcoin, 1 buyer; and that Transaction Number 1 is of course recorded on a blockchain, with data essentially of at least "Transacted as at <date 1>". Yes, or no? Or what?**

Yes, the transfer is recorded. In fact if you go to <https://www.blockchain.com/btc/block/000000000000000000000000f938f46a145f5f85a5e956f04751367affec12128eb4d> and click on the address highlighted above you will see that transactions have subsequently transferred elsewhere. Scroll down the page and you will see an example:

Hash	0e8a76bafc9a2179c2cb9e1d98b0b7efd624...	2020-03-10 11:04
	bc1qscxza3clrcd9qag3... 2.92836949 BTC	
	1CK6KHY6MHgYvmRQ... 12.71716448 BTC	
	→	
		bc1qu6eak33jwf5y5e3r... 0.01018730 BTC
		1Hqse5scWX5wxECRSw... 0.01011556 BTC
		39M4WgVdrs1xsnBWT... 0.00108457 BTC
		16GD5oi2gzh5xmKbL2... 0.00103689 BTC
		1EWmnpM2uj79uYpt1... 0.01009900 BTC
		38PBbTyLF2YfgYH3Qy... 0.00540305 BTC
		3PzGJRKmHG547bXlK... 0.38685691 BTC
		17AEm14WxFMEMUWL... 0.00092454 BTC
		3CzuzgHGmjihixLaqpt9... 0.01002275 BTC
		bc1qx9afa9zlmldfis0... 0.00296369 BTC
		Load more outputs... (438 remaining)
Fee	0.00374450 BTC (24.864 sat/B - 6.250 sat/WU - 15060 bytes)	-12.71716448 BTC

So it looks like this busy miner has paid out a bunch of BTC to over 400 addresses in one transaction. The challenge is that, just like money in your bank account, there is no way of knowing that any particular amount is directly from another amount (because it isn't).

**5. To keep it simple, let's assume that this first new owner of that 1 bitcoin did not own any bitcoins prior to his/her purchase thereof, and after Transaction Number 1 does not add to his/her holding. This first owner now has the bitcoin essentially 'stored alone' in his/her wallet, i.e 'containing' just that same single bitcoin address "1Ez69SnzzmePmZX3WpEzMKTrcBF2gpNQ55". Yes or no? Or what?**

Let's not mix up wallets and addresses. The Bitcoin Blockchain allocates BTC values to addresses. A wallet, whether hardware or software, simply holds details of those addresses. A wallet also usually has functionality to store public and private keys and can sign transactions, using the Elliptic Curve Digital Signature Algorithm (ECDSA [https://en.bitcoin.it/wiki/Elliptic\\_Curve\\_Digital\\_Signature\\_Algorithm](https://en.bitcoin.it/wiki/Elliptic_Curve_Digital_Signature_Algorithm)). If we looked at the history of that person's bitcoin address, we would indeed just see the one transaction coming in.





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**6. Transaction Number 2: that first owner sells that same 1 bitcoin to another person (again, to keep it simple, owning no bitcoin prior to this transaction, and none further added afterwards). This Transaction Number 2 is also recorded on a blockchain, with data essentially of at least "Transacted as at <date 1.1>". Yes, or no? Or what?**

Yes, with same caveats as above, it shows value transfer from Address A to Address B. If you've looked at some of the transactions on the explorer you'll get this now.

**7. The second owner, in turn, now has the bitcoin alone stored in his/her wallet, 'containing' just that same single bitcoin address "1Ez69SnzzmePmZX3WpEzMKTrcBF2gpNQ55". Yes or no? Or what?**

Not quite. Remember values are stored against addresses. Wallets store addresses. Wallets don't therefore hold bitcoin, they provide the means to access them.

**8. After N such simple identical sell-buy transactions we arrive at, say, Richard, owning that same 1 bitcoin, by way of Transaction Number N, "Transacted as at <date 2>"; and thus someone is then able to say, by appropriately interrogating the relevant blockchain records: This 1 bitcoin has "wallet address {XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX}. It was originally mined by {who?} in {where?}, and after being mined was transferred (bought and sold) [N] times between <date 1> and <date 2>". Yes or no? Or what?**

No. But... We can use the Bitcoin Blockchain to see values allocated to addresses changing. So we could see that Richard had 1 BTC "worth" in his address 12345xxxxx and then a message with a transaction to "move" 0.5BTC to Stephen's address 6789xxxx took place. And we would also see the remaining 0.5BTC being sent back to Richard's address because Bitcoin uses 'unspent output from bitcoin transactions' (UTXO <https://www.investopedia.com/terms/u/utxo.asp>).

This is where there can be potential befuddlement between those who regularly transact in BTC who *think* they understand how it works, versus those who *know* how it *actually* works. For example, prosecuting authorities can bring actions against crypto scammers, fraudsters and illegal users of BTC because prosecutors don't have to prove a specific BTC was used in illegal activity (think 'individual banknote' in fiat currencies). This is similar to how a drug dealer will have an entire bank account seized and not just the individual USD notes that were obtained illegally. You can track transactions between Bitcoin accounts. But the transactions are *changes in ledger balance values* and *not* movements of specific coins, albeit the latter is what it looks like to those who don't know better.

Furthermore, the ledger balances and the Bitcoin accounts could all be owned by entirely different real people or, equally, they could all simply be in the legal ownership and control of the same person – just as for USD, the same person may hold and operate several different bank accounts, and also either with the same bank, or with different banks, and move his or her own USD between them. Bitcoin value movements as tracked on the Bitcoin Blockchain and as may be recorded as changes in addresses accessed via wallets may in reality be nothing more than the digital currency equivalent of someone moving his or her own USD notes and coin 'from one pants pocket to another'.



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Just as anyone could have many different (varying) piles, or pockets full, of USD notes and coins, and many different pants pockets, all of which could change with time, with no one-to-one relationship ever among them, so any one person could have many different, changing BTC values recorded on the Bitcoin Blockchain, and many different wallets recording, dynamically, their addresses.

### ***The fundamentals of analysis of cryptocurrency and blockchain transactions***

There is much in the technical literature on analysis of cryptocurrency and blockchain transactions, including in regard to identifying and verifying account holders, and associated transactions carried out by them **[1]**. To my knowledge few, if any, techniques and processes that seek to do this have achieved wide or generally-recognised standing either legally or technically.

It should be borne in mind that *blockchain* still has few settled international standards, and the concept, and device-implementation, of a *cryptocurrency wallet*, its definition, structure, meaning, interpretation and use are not wholly standardised or consistent. They are also operationally dependent on, and subject to manipulation by, wallet-specific private vendor software, which is rarely independently verified or checked as to functional correctness or adequacy, quality, reliability, consistency, security and forensic provability **[2]**.

Cryptocurrency frauds and scams routinely occur and the amounts of fiat money now relentlessly misappropriated criminally runs to many billions of USD. It is a feature of these activities that (i) they principally involve proprietary third-party transactional software and systems (eg that running and offered by cryptocurrency trading exchanges), the 'on and off ramps' that connect the trader, the end-user consumer, to the secure cryptocurrency blockchain itself: such systems may be of questionable, and unaudited, provenance, quality or reliability; and (ii) since cryptocurrency trading is essentially globally unregulated **[3]**, with few checks by authorities or regulators on the *bona fides* or substantive financial standing of the promoters and operators thereof, investigators and prosecutors have difficulty identifying and/or catching perpetrators. If and when they do, they have additional challenges in securing the relevant fraudulent transactional blockchain and misappropriated crypto-asset movement evidence sufficient to prove an offence and gain a conviction to the usual 'beyond a reasonable doubt' standard.

In short, it is widely recognized that digital currencies, such as Bitcoin, readily offer convenience and security to criminals, who operate in an essentially 'black market'. And this state of affairs is unlikely to change whilst cryptocurrencies continue to exist and their trading transactions persist operationally without the backing and responsibility of Regulated/Trusted Third Parties, and thus, it has been argued, essentially outside the Rule of Law **[4]**.

For the same reason, it should be noted that investigators examining transactions and holdings of reputable and ordinary citizens who may legitimately trade and invest in cryptocurrency need to take care not to make inferences and draw conclusions of supposed illegal intent on the part of such traders and investors based only on technical analysis. Blockchain may, by virtue of its cryptographic data recording and distributed consensus mechanism, provide technically a decentralized 'trust' architecture; but blockchain, in and of itself, cannot necessarily constitute a sound, robust, rigorous, trusted and authenticated 'chain of evidence' upon which to rely to prove apparently suspicious intent and possibly unlawful actions.



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### ***Illustrative References***

**[1]** Examples:

<https://link.springer.com/article/10.1007/s41109-019-0249-6>

*Quantitative analysis of cryptocurrencies transaction graph Amir Pasha Motamed & Behnam Bahrak  
Published: 30 December 2019*

*Introduction Cryptocurrencies have made it possible for a financial system to perform transactions without the need for a centralized authority while keeping the transaction details and money generation clear and publicly available. Despite this transparency, people's identities are hidden, and they can transact anonymously. All transaction information of a cryptocurrency is usually stored in a distributed public ledger, named blockchain. The tasks of recording, updating, and maintaining the blockchain is the responsibility of network users for each coin, whose identities are unknown, and rewards have been created to provide them with sufficient incentives to do so, making the network up and running. Although the system is running by anonymous people, due to computational infeasibility of forging digital signatures and security of cryptography algorithms, transaction alteration is almost impossible. This level of security is guaranteed by cryptographic algorithms, and as long as these algorithms are secure, cryptocurrencies integrity is protected. ...*

[https://www.researchgate.net/publication/277248535\\_Identifying\\_Bitcoin\\_users\\_by\\_transaction\\_behavior](https://www.researchgate.net/publication/277248535_Identifying_Bitcoin_users_by_transaction_behavior)

*Identifying Bitcoin users by transaction behavior Vinnie Monaco Naval Postgraduate School April 2015  
DOI: 10.1117/12.2177039 Conference: SPIE DSS*

*ABSTRACT Digital currencies, such as Bitcoin, offer convenience and security to criminals operating in the black marketplace. Some Bitcoin marketplaces, such as Silk Road, even claim anonymity ... This claim contradicts the findings in this work, where long term transactional behavior is used to identify and verify account holders. Transaction features, such as timestamp, coin-flow, and connectivity, contribute to revealing the account-holder's identity. The time between successive transactions is the result of low-frequency effects, such as the desire purchase an item and daily schedule, as well as higher frequency effects, such as hardware and network latency. In addition to transaction time-intervals, dynamic network features of each transaction, such as coin flow and number of edge outputs and inputs, can also be used to identify account-holders. In this paper, we propose novel methodology for identifying and verifying Bitcoin users based on the observation of Bitcoin transactions over time. ... A subset of Blockchain 230686 is analyzed, selecting users that initiated between 100 and 1000 unique transactions per month for at least 6 different months. This dataset shows evidence of being nonrandom and nonlinear, thus a dynamical systems approach is taken. Identification and verification accuracies are obtained using monthly Bitcoin samples. Outgoing transactions, as well as both outgoing and incoming transactions, are considered. Results show an inherent lack of anonymity by exploiting patterns in long-term transactional behavior. ...*

<https://www.frontiersin.org/research-topics/12966/cryptocurrency-transaction-analysis-from-a-network-perspective>

*Cryptocurrency Transaction Analysis from a Network Perspective*

*Cryptocurrencies ...store their transactions publicly in blockchains. These longitudinal transaction records form large temporal networks of millions of nodes (addresses or accounts) and billions of edges (coin transfers or program function calls) connecting them together. They are probably the largest empirical datasets of complex networks, or graph data, publicly available. Cryptocurrencies have a wide adoption in (dark) markets and financial activities (for example, goods purchasing, fundraising, etc.), criminal activities (for example, fraud, money laundering, pyramid schemes, etc.) and gaming (for example, gambling, lottery, etc.). The public transaction records contain rich information and complete traces of these activities. ...*

<https://www.chainalysis.com/professional-services/>

*Advanced blockchain forensics Combining expertise in Chainalysis software, open source data analysis, and the latest investigative techniques, our team makes the cryptocurrency space safer by tackling the most challenging cases.*



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**[2]**

<https://www.iso.org/committee/6266604.html>

ISO/TC 307 Blockchain and distributed ledger technologies

Scope: Standardisation of blockchain technologies and distributed ledger technologies.

5 published ISO standards. 12 ISO standards under development under the direct responsibility of ISO/TC 307. 43 Participating members. 19 Observing members.

'Blockchain – The Legal Implications of Distributed Systems', The Law Society HORIZON SCANNING August 2017, 12 pages.

<https://hackernoon.com/what-are-the-requirements-for-a-modern-crypto-wallet-fwt130jw>

*What Are the Requirements for a Modern Crypto Wallet? August 28th 2019 Kirill Shilov*

*Out of the 18 million of mined Bitcoins, nearly 27% are out of circulation, and most of those are supposedly lost. ... the majority of them are lost due to mistakes in money management. That's why the importance of crypto wallets increases every day ... The first crypto wallet ... was very simple: it allowed for the generation of new addresses and sending BTC to other people. No special measures were taken to protect or recover the private key, and it was easy to type an incorrect address and send coins to the wrong destination. ... The first exchange was launched in 2010, called Bitcoinmarket.com. The next year, 2011, was the year when Mt.Gox was launched, and people started to use it as some kind of a wallet. The Mt.Gox hack (when its users lost nearly 650,000 BTC) taught us not to store crypto on exchanges, and the demand for secure crypto wallets increased. Over time, many new wallets such as Exodus and Jaxx appeared, with multi-currency support and new security features. Nowadays, there are a lot of competing wallets for any currency ...*

<https://www2.deloitte.com/mt/en/pages/technology/articles/mt-article-cryptocurrency-security-standard-CCSS.html>

*Cryptocurrency Security Standard (CCSS) By Sandro Psaila: IT Audit Senior Manager*

*As cryptos are expected to shift into the mainstream, one of the biggest challenges is confidence. Can CCSS bridge the gap? ... People and organisations are concerned about the authentication, authorisation and/or confidentiality limitations of cryptocurrency transactions. ... By standardising the security techniques and methodologies used by crypto systems around the globe, end-users will be able to make educated decisions more easily about which products and services to use and with which companies they wish to align. On the other hand, many cryptos, like Bitcoin, are not governed by a central control point or "authority"; standardising on security will be a challenging process. ... Although this standard has been around since 2014 and the number of crypto systems have mushroomed recently, very few organisations are claiming adherence with the CCSS when it comes to the management of crypto wallets. In fact, it is perceived that a considerable number of businesses in this space, mainly start-ups, do not follow security best practices, and their operations do not meet minimal security standards. ...*

**[3]**

'In a new Survey, a Majority of Attorneys & Expert Witnesses Call for Increased Cryptocurrency Regulation', by Dr Stephen Castell CITP, EXPERT WITNESS JOURNAL, AUGUST 2021.

**[4]**

'Blockchain vs Trust: The Fundamental Expert Dilemma', by Dr Stephen Castell, EXPERT WITNESS JOURNAL, WINTER 2019.

<https://www.arachnys.com/2019/10/22/addressing-the-aml-risks-of-cryptocurrencies/>

*Addressing the AML risks of cryptocurrencies OCTOBER 22, 2019 BLOG*

*With the recent explosion in cryptocurrencies, from the early beginnings of Bitcoin back in 2009 ...in 2019, there still remains serious unanswered questions about the money laundering risks they bring to banks, consumers and regulators. Ciphertrace's 'Q2 2019 Cryptocurrency Anti-Money Laundering*

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*Report' ... claims that theft, scams and other forms of misappropriation of funds "from cryptocurrency users and exchanges netted criminals and fraudsters approximately \$4.26 billion in aggregate." ... Dr Stephen Castell, an independent FinTech consultant, admits that there are few innocent investor protections to fall back on: "This is essentially the case worldwide today, and it looks like it will continue that way for the foreseeable future." ...*

*Digital Bytes, Weekending 26th October 2019, TeamBlockchain Ltd.*

<http://www.teamblockchain.net/>

*... Binance's latest quarterly results ... in the last two years it has made over \$1billion of profit. CEO of Binance, Changpeng Zhao, ... established Binance only in 2017. Binance raised \$15 million via an Initial Coin Offering (ICO) and CZ is reported to be worth \$1.2 billion. Binance, based in Hong Kong, is different from its competitors ... based in the USA e.g. Coinbase (San Fran), Kraken (San Fran), Bittex (Las Vegas) and Bitbox (NYC). The amount of Cryptos that were traded in September 2019 on exchanges like Binance was still over \$500 billion - down from nearly \$800 billion in June 2019. According to the website Coin.Market there are now over 260 different Crypto exchanges ...*

*'Code of practice and management guidelines for trusted third party services', S. Castell, INFOSEC Project Report S2101/02, 1993.*

*The APPEAL Report, Dr Stephen Castell, 1990, Eclipse Publications, ISBN 1-870771-03-6).*



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## 8. Expert's Declaration and Statement of Truth

### Expert's Declaration

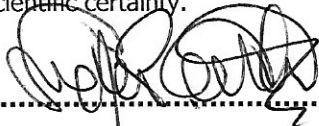
I Stephen Peter Castell DECLARE THAT:

1. I understand that my duty in providing written reports and giving evidence is to help the Court, and that this duty overrides any obligation to the party by whom I am engaged or the person who has paid or is liable to pay me. I confirm that I have complied and will continue to comply with my duty.
2. I confirm that I have not entered into any arrangement where the amount or payment of my fees is in any way dependent on the outcome of the case.
3. I know of no conflict of interest of any kind, other than any which I have disclosed in my report.
4. I do not consider that any interest which I have disclosed affects my suitability as an expert witness on any issues on which I have given evidence.
5. I will advise the party by whom I am instructed if, between the date of my report and the trial, there is any change in circumstances which affects my answers to points 3 and 4 above.
6. I have shown the sources of all information I have used.
7. I have exercised reasonable care and skill in order to be accurate and complete in preparing this report.
8. I have endeavoured to include in my report those matters, of which I have knowledge or of which I have been made aware, that might adversely affect the validity of my opinion. I have clearly stated any qualifications to my opinion.
9. I have not, without forming an independent view, included or excluded anything which has been suggested to me by others, including my instructing lawyers.
10. I will notify those instructing me immediately and confirm in writing if, for any reason, my existing report requires any correction or qualification.
11. I understand that –
  - (a) my report will form the evidence to be given under oath or affirmation;
  - (b) questions may be put to me in writing for the purposes of clarifying my report and that my answers shall be treated as part of my report and covered by my statement of truth;
  - (c) the Court may at any stage direct a discussion to take place between experts for the purpose of identifying and discussing the expert issues in the proceedings, where possible reaching an agreed opinion on those issues and identifying what action, if any, may be taken to resolve any of the outstanding issues between the parties;
  - (d) the Court may direct that following a discussion between the experts that a statement should be prepared showing those issues which are agreed, and those issues which are not agreed, together with a summary of the reasons for disagreeing;
  - (e) I may be required to attend Court to be cross-examined on my report; and
  - (f) I am likely to be the subject of public adverse criticism by the judge if the Court concludes that I have not taken reasonable care in trying to meet the standards set out above.

### Statement of Truth

I confirm that, insofar as the facts stated in this my **Preliminary Expert's Report** are within my own knowledge, I have made clear which they are and I believe them to be true; and that the findings I have presented represent my true and complete professional analysis, conclusions and opinion for the purposes of such a report and all of the opinions expressed herein are opinions which I hold to a reasonable degree of scientific certainty.

Signature



Date

DECEMBER 19TH, 2021

Dr Stephen Castell, **CASTELL Consulting**

December 19, 2021